DOCUMENT RESUME

ED 352 082 JC 930 002

AUTHOR Packer, Arnold
TITLE An Associate Degree in High Performance Manufacturing.
PUB DATE 5 Oct 92
NOTE 20p.; Paper presented at the National Tech Prep Network Conference (Chicago, IL, October 4-6, 1992).
PUB TYPE Viewpoints (Opinion/Position Papers, Essays, etc.) (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Articulation (Education); *Associate Degrees; College School Cooperation; Community Colleges; *Computer Assisted Manufacturing; Curriculum Development; *Labor Force Development; *Manufacturing Industry; Program Development; Program Proposals; *School Business Relationship; *Skill Development; Technical Education; Technological Advancement; Two Year Colleges
IDENTIFIERS *High Performance Manufacturing

ABSTRACT

In order for more individuals to enter higher paying jobs, employers must create a sufficient number of high-performance positions (the demand side), and workers must acquire the skills needed to perform in these restructured workplaces (the supply side). Creating an associate degree in High Performance Manufacturing (HPM) will help address four interdependent supply-side issues. First, such a degree can serve as a link for achieving the three-fold integration of K-12 and postsecondary education; education and work; and vocational and academic education. To achieve this integration, a common language can be taught at each level and in each setting. The Secretary's Commission on Achieving Necessary Skills (SCANS) cites the following five principal competencies which can be taught and/or used at all levels of education and work: planning resources skills; information skills; interpersonal skills; systems knowledge; and technology skills. Second, an HPM associate degree can assist employers in recruiting and developing a workforce competent in high-performance work. Third, the HPM degree, which would be a portable degree, well understood and valued throughout the manufacturing industry, can serve to motivate students to acquire the skills needed for high-performance work. Finally, an associate degree in HPM would improve the effectiveness of education in preparing workers for the 21st century. Meetings involving representatives of manufacturing firms and trade associations, unions, community colleges and state systems, and other training organizations, is the first step to developing such a degree. Data tables are included. (PAA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED352082

AN ASSOCIATE DEGREE IN HIGH PERFORMANCE MANUFACTURING

by Arnold Packer

Institute for Policy Studies
Johns Hopkins University

Presented at the
National Tech Prep Network Conference
Marriott Downtown
Chicago, Illinois

October 5, 1992

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

A. Packer

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)"

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☒ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

JC 930002

BEST COPY AVAILABLE

Proposed: That the U.S. manufacturing industry -- its leading firms, trade associations, and unions -- work together with educators to specify a curriculum leading to a Associate Degree in High Performance Manufacturing.* This degree should serve as a portable certificate among diverse employers, certifying that its holders are competent to perform in the evolving manufacturing workplace and can continue learning as work requirements change. Youngsters and experienced workers should be able to earn credits towards the degree in the widest possible way.

I. INTRODUCTION

The proposal made above is directed to increasing the earnings and productivity of American workers. As seen in Figure 1, the percentage of males with 12 years of education who earn enough to keep a family of four above poverty is shrinking. For African American males the percentage has shrunk from 80% in 1969 to 57% in 1989. In the words of a recent and well-received report, the proposal is part of America's Choice: High Skills or Low Wages. The premise is that the high-wage choice requires two things: employers creating a sufficient number of high-performance jobs (the demand side) and workers acquiring the skills needed to perform in these re-structured workplaces (the supply side). Each of these two require, in turn, that a host of other issues be resolved satisfactorily.

The paper argues that creating an Associate Degree in High Performance Manufacturing will help with the following four interdependent supply-side issues:

1. **Integrate** K-12 and post-secondary education, education and work, and vocational and academic education.
2. **Assist employers** to recruit and develop a work force competent to perform high-performance work.

---

* The concept should be extended to other broad sectors of the economy, leading to a series of Associate Degrees in Health, Construction, Retailing, Finance/Insurance, Hospitality Industries, Distribution/Communication and a few more.

3. **Motivate students** to acquire the skills needed for high-performance work.

4. **Improve the effectiveness of education** in preparing workers for the 21st century.

II. SCANS AND THE THREE-FOLD INTEGRATION.

Many observers are calling for the three-fold integration of: K-12 and post-secondary education, education and work, and vocational and academic education. The first of these is often spoken of in terms of Tech Prep or 2+2 or more recently 2+2+2+2. (The original was the last two years of high school and two years of community college. Recent additions include middle school on the front end and the last two years of college on the back end of the original.)

The second integration is often referred to as the school-to-work transition. Integration, however, is clearly a better term than transition, given ubiquitous part-time student work and the need for lifelong learning. The barriers that separate the worlds of school and work must be broken down.

The third integration, of academic and vocational learning, would eliminate the general track in high school. Indeed, it would keep students in a single track through age 16 or until they achieved a Certificate of Initial Mastery. (See America's Choice and Figure 2.) Instead of narrow vocational education or irrelevant "academics," students will acquire broadly-applicable knowledge and skills. These will always be taught in context, and often in the context of real workplace problems. After age 16, many students will begin to specialize in broad occupational or industrial domains in magnet or theme high schools, and embark on the 2+2 (2+2+2) path.

True integration of cultures is only possible if there is a common language. In this instance a language is needed that can be used in elementary and middle school, high school, community college, and four year college and at work and in academic and

"vocational" courses. The language must bridge the cultures that reign in these various domains.

The Secretary's Commission of Achieving Necessary Skills (SCANS) goal was to create such a language, one that could be used at all levels of education and at work. The SCANS language describes five competencies that the Commission's research found were needed for high performance work. This language can describe part of what can be taught in first grade and in graduate school. SCANS should be the language used by employers' human resource (HR) departments when they recruit and develop their employees. SCANS should be the language used in the Labor Department's revised Dictionary of Occupational Titles (DOT) and for the "voluntary" industry skills standards whose development is starting to be funded by the U.S. Departments of Labor and Education.

As shown in Figure 3, the five SCANS competencies are:

-o- Planning Resources (budgeting, scheduling, and allocating staff and space),

-o- Information (acquiring and evaluating data, communicating in oral and written form, using computers),

-o- Interpersonal skills (working in teams that may be multi-cultural, negotiating, and teaching),

-o- Systems (applying the concepts of Total Quality Management and Statistical Process Control), and

-o- Technology (using, selecting, and maintaining technology).

These competencies are what is needed for high performance work and, even today, bring substantially higher wages to those who have and use them at work. The SCANS research examined the level of proficiency in these skills in 200 interviews among 50 jobs. The higher-paying of these jobs paid $11,000 more annually than the lower-paying positions. As shown in figure 4, workers in the higher-paying jobs are more proficient in the SCANS competencies.

These SCANS competencies can be taught as part of academic high school subjects (mathematics, english, etc.) These same competencies can also be taught in a work task. For example, students can be taught:

-o- Planning and scheduling in mathematics;
And by scheduling a work shift at a hospital.

-o- Information skills by analyzing data in a geography class;
And by collecting and analyzing data for a social service agency.

-o- Interpersonal skills by reading foreign authors and learning about cultural diversity in english;
And by working on a multi-cultural team in an office.

-o- Systems by analyzing population growth rates in history;
And by evaluating error rates in an environmental test.

-o- Technology by using test instrucments in science;
And by using equipment on a construction job.

These competencies can be taught at all levels of education and can be part of the skills standards for many jobs. Rudimentary scheduling, for example, can be taught in first grade and in graduate mathematics. Scheduling a work shift or expensive piece of equipment should be part of the skills standards for a number of jobs in manufacturing, health, and other industries. A similar case can be made for the information skills; data collection and analysis can start in first grade, can be re-interpreted in a science or history class, and should be part of the skills standards for a number of occupations in the finance industry (and in other industries as well). Negotiations can be studied in history (e.g., the Louisiana Purchase), appear in children's games (Monopoly), and would be part of studying for a law degree or to meet the standards for a para-legal or for real estate sales.

The concepts of quality could be taught in statistics at all levels and would apply in many industries although the skill standards for a health-care worker might emphasize different aspects of quality than for someone in the hospitality industry. Technology, broadly defined, could be taught to fourth graders and in 10th grade science and experience with construction technology should be part of the skills standard for a project engineer.

In what follows the discussion will be restricted to manufacturing. The concept could and should, however, be extended to other broad sectors of the economy, leading to a series of Associate Degrees in Health, Construction, Retailing, Finance, Hospitality Industries, Communication and a few more.

The manufacturing industry would work with educators to determine the generic and industry-specific aspects of planning, information, interpersonal skills, systems, and technology needed for an Associate Degree in High Performance Manufacturing. The process of working out the details of a such a degree would encourage integration between school and work and be a step toward voluntary industry-specific standards. The process would integrate school and work. Students and employers would see how the two worlds fit together.

III. ASSIST EMPLOYERS OBTAIN A HIGH-PERFORMANCE WORKFORCE.

Employers want high performance workers in adequate numbers and are willing to pay more for those who are more proficient in the SCANS competencies. As shown in figure 4, workers who do more difficult SCANS tasks earn $11,000 more in the sample of selected jobs.

Manufacturing employers often bemoan students' lack of interest in manufacturing (some kids think the work is dirty and noisy and un-glamorous). Moreover, those youngsters that are interested in manufacturing are often inadequately prepared, especially if they have stopped their schooling immediately after (or before) finishing high school. Adult manufacturing workers are often not eager to continue their education on their own time, sometimes even when tuition reimbursement is available. Employers are also concerned that if they invest in their human resources, the newly trained employees will leave for greener pastures at a competitors' firm. Finally, even if employers decide to look beyond these problems and provide training they often find it difficult to evaluate the training vendors or design programs that

will fit. These problems are often severely felt by smaller firms. [Southport].

What can employers do to overcome these problems? The answers lie in the torrent of ideas that are associated with phrases such as "the quality movement" or "total customer service" or "high performance workplaces." These ideas were brought to American firms by Dr. Edwards Deming and others after they successfully applied them in Japan. [Made in America; MIT Press] These new ideas are still evolving as manufacturing firms introduce "lean production" and as governments craft policies regarding education and training and grant Baldridge awards.

"High performance" thinking implies a new relationship between the manufacturing industry and education at all levels. The workers' role in achieving quality manufacturing is an important strand of the new thinking. More and more firms are coming to understand that their workers' skills are as important as the equipment they have on the factory floor. Early in the 1980's this lesson was dramatically drawn by the different experiences of GM and Ford. While GM thought it could automate to quality, Ford opted to invest in its workers. Because of Ford's success, most firms are now trying the human resource route.

Flat organizations, decentralized responsibility, empowerment, and more training and education are words in the daily conversations at most corporate human resource (HR) departments. Although top management finds it difficult to reconcile these words with the realities of down-sizing, especially during the lengthy economic slowdown, the new ideas have captured the imagination of HR departments in our world-class firms. (Some believe that training budgets have not been cut as much as is usual in the current downturn.)

Another strand of the new thinking is the changed relationship of producers to their suppliers. Dr. Deming warns against awarding business to vendors on the basis of price alone. Deming's recommends that firms become partners with their vendors, working

with them to meet future needs for performance and quality while recognizing the vendors' legitimate concerns.

The new relationship that GM is building with its suppliers is a recent example of the innovations that are possible. (Vendors have been invited to use GM facilities and GM workers.) The experience of Motorola is more relevant to the proposal. Motorola requires its vendors to apply for the Baldridge award and helps them do it. It also requires that vendors' train their workers in statistical process control (SPC) and helps in that process. The latter policy is also followed by DEC, Xerox, and Boeing. Some vendors, those who sold to more than one of these four firms, complained that their workers were taking three or four SPC courses. So the four firms allowed cross-certification; taking an SPC course with one sufficed to meet the requirements of the other three. These four firms, thereby, established a de facto standard for SPC training for their part of the industry. Similar processes are beginning in training for those who network computers where firms have joined together with a testing organization to develop a certificate honored throughout the industry.

The 1990's high performance manufacturing firm will have a high performance human resource department. Foremost, the new HR department will re-conceptualize their function in the same way that procurement departments are re-conceptualizing theirs. In earlier times procurement department were responsible for finding good vendors and buying their products at good prices. Today, they are charged with developing vendors. Today, most HR departments are only supposed to recruit good employees without any responsibility for developing the schools that prepare them. Tomorrow, the HR department will no longer only be responsible for selecting the best employees from the pool of available applicants, and developing and retaining those hired.

HR departments will soon become responsible for the quality of the pool itself. They will seek to improve the pool of workers that is available to their vendors as well. In other words, HR departments will be charged with ensuring that the education system

is producing enough applicants capable of working in the high performance manufacturing firm so that they and their vendors can remain competitive with Asian and European firms. Motorola, for example, takes these responsibilities quite seriously.

This broader set of HR responsibilities requires that HR departments treat the schools as their suppliers and work with them. But just as the vendors to Motorola, DEC, Boeing, and Xerox could not meet separate SPC training needs for all four firms so do educators need some agreement among employers about SPC education and, more broadly, about the other skills needed for high performance work. In other words, HR departments in the industry have to work together to achieve the goal of a high-performance manufacturing workforce.

Manufacturing firms can undertake the following steps:

1. Make the SCANS language part of the way jobs are described, recruiting guidelines are written, and employee development programs are designed. The National Restaurant Association and other associations in the hospitality industry are moving in this direction. A similar effort is needed in manufacturing.
2. Work with educators to agree on the performance standards for the various certificates, degrees, and diplomas that are granted by educational institutions of all types. Specifically, work together to develop the requirements for a Associate Degree in High Performance Manufacturing.

IV. MOTIVATING STUDENTS

Workers and students want satisfying jobs at good wages. They complain, especially during a recession, about the lack of good jobs, even for those with skills. They also complain that school-based education is irrelevant and work-based training is too narrow. Finally, many workers with family responsibilities just do not have the time (or energy) to pursue education and work simultaneously, especially when classes are physically remote from the workplace and schedules are inconvenient.

Educators who seek to serve employers, a characteristic of community and junior colleges, complain that employers often want narrow job-based skills that change too rapidly. Often, by the time academic programs are put together the jobs for their graduates have evaporated. Enrollment then falls and the investment in a new curricula is wasted.

How will an Associate Degree in High Performance Manufacturing solve, of at least diminish, these problems? A worthwhile transportable degree should increase the demand for learning high performance education on the part of students and workers. If a great many manufacturing firms "buy in," then holders of the certificate are going have a better chance of getting a job somewhere in the country. Studying for the new degree would become attractive to youngsters graduating high school and, also, to those already in the workforce.

In other words, a portable degree, well understood and valued throughout the manufacturing industry is valuable while a collection of courses are not. More students, young and old, should resolve their own cost-benefit calculus in favor of making the effort to acquire such a degree, especially if there are many paths to obtaining it.

How about the supply of good curricula, educational materials, and teachers so that the degree could be pursued on a campus, at the worksite, and at home? Publishers will only develop educational materials if there is a market, not if courses come and go and change from year to year. The same holds for teacher training. Without some economies of scale the chances of getting good courses diminish. With industry agreement on the requirements for a degree, private vendors and public institutions, including community colleges, will create multiple paths to meeting the requirements.

Two reasons argue for beginning at the Associate Degree level. First, this is the part of the overall education system that is most adaptable. Community colleges are accustomed to developing programs for industry and their curricula fights are much less

difficult than those at either higher or lower levels of schooling.

Second, the greatest overall demand is likely to be at this level. Although many of the ideas sketched out in this paper apply to bachelors degrees also, workers already in the labor force often find a bachelors degree program too lengthy. The ideas are also relevant for high school diplomas, especially for diplomas from vocational high schools. Yet, workers already having a diploma would have no interest in returning to high school for such a program. Associate degrees, on the other hand, will attract many students still in school and the overwhelming majority of the year 2000 manufacturing workforce that is already at work.

Moreover, there would be spillover into the high school and even lower grades if a new degree existed. [Parnell] The new Perkins Act encourages tech-prep or 2+2 programs that start after the 10th grade and culminate with an associate degree. The lower grades would be affected as middle school students began to prepare for a 2+2 program in manufacturing. An Associate Degree in High Performance Manufacturing would also encourage 4-year colleges to provide a Bachelor of Sciences in High Performance Manufacturing.

For this scheme to work, the Associate Degree will have to mean that the education really increases the productivity of the degree-holder. That depends on how well the curricula is designed and the teaching is delivered.

V IMPROVE THE EFFECTIVENESS OF EDUCATION

Another strand of the new high-performance thinking is the emphasis on the customer. The thinking applies, in this case, to the education system and its need to enter into real dialogue with manufacturing employers, one of education's important customers. This dialogue has to extend into the details of curricula and assessment so that manufacturers' HR departments will, indeed, strive to recruit and develop workers who have the Associate Degree in High Performance Manufacturing.

Employers and educators should agree on the things one needs to know to work productively in a high performance manufacturing environment. The parties should agree on what it takes to apply statistical process control, on the types of manufacturing information that need to be analyzed and communicated, on the issues that are likely to be negotiated, on what it takes to create an effective work team in manufacturing, and on what students should know about manufacturing technology. Answers to these questions should shape the curricula objectives for the Associate Degree.

The SCANS competencies, coupled with the information that will become available from the "voluntary" industry skills standards, should provide a foundation for this effort. The Associate Degree would permit students to major in industries that are likely to be developing skills standards, such as electronics. Thus, for an Associate Degree with a major in Electronics the technology course would be an electronics elective while SPC or interpersonal skills might be a core requirement for all students.

The first step is to bring representatives from the following organizations together to develop the requirements for the Associate Degree in High Performance Manufacturing:

-o- Manufacturing firms and trade associations (especially those proposing to develop skill standards);

-o- Unions and union/management training organizations;

-o- Selected community colleges and state systems and the American Association of Community and Junior Colleges (AACJC); and

-o- Other training organizations, especially those involved in distance learning.

The next steps are to develop model curricula and pilot it in a number of colleges across the country, perhaps one in each state and one in selected major cities.

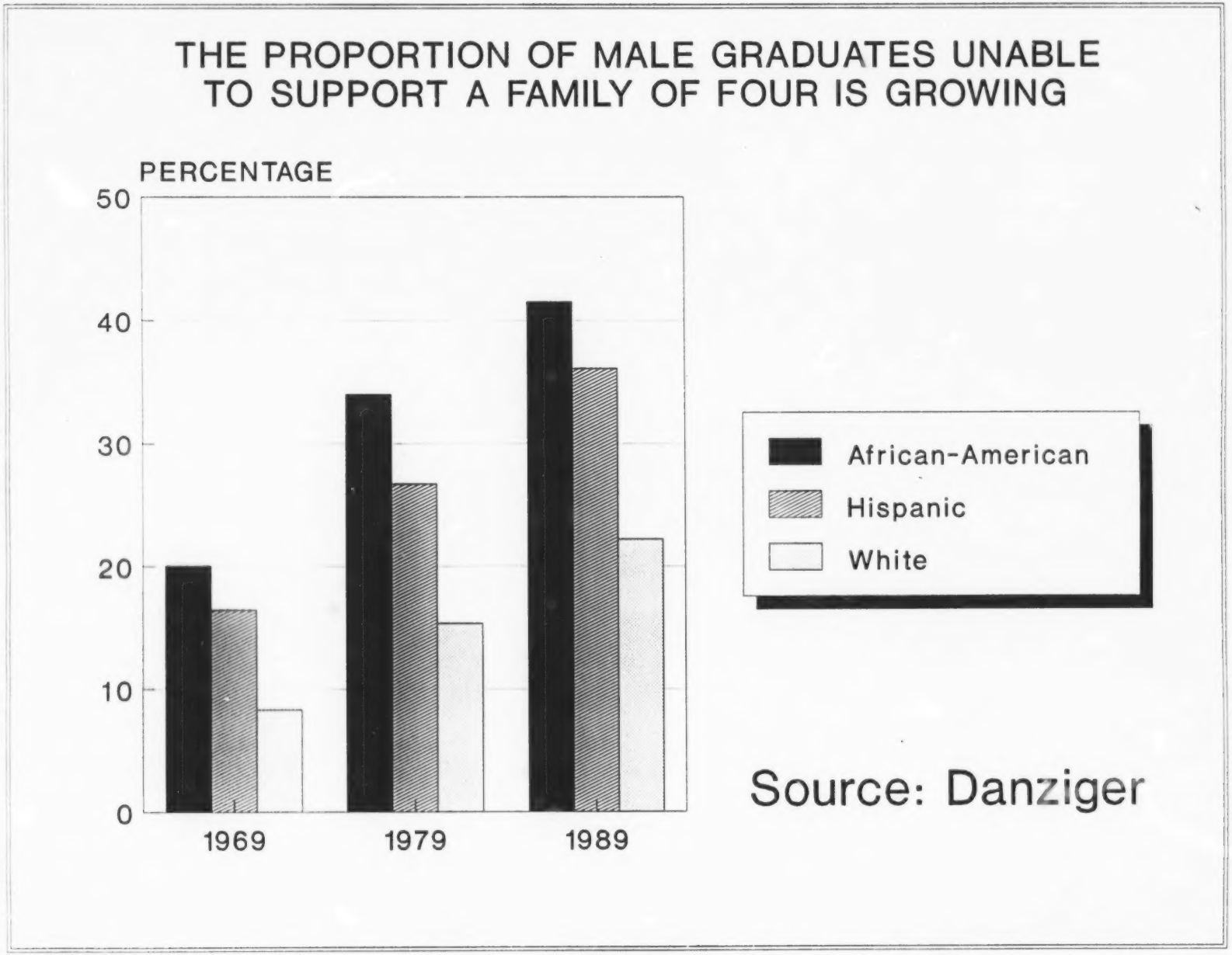

THE PROPORTION OF MALE GRADUATES UNABLE TO SUPPORT A FAMILY OF FOUR IS GROWING
PERCENTAGE
50
40
30
20
10
0
1969
1979
1989
African-American
Hispanic
White
Source: Danziger

Figure 1

INTEGRATING SCHOOL AND WORK

ELEMENTARY	MIDDLE	HIGH	POST-SECONDARY
Basic	**Academic**	**Option**	**Occupational**
Reading Arithmetic	English History Science Mathematics Geography Foreign Lang. Art	Academic Subjects Straight or in a Occupational Theme	Health Manufacturing Construction Financial Retailing Hospitality Communication
TRACKING?			
None	None	Some*	All
SCANS TAUGHT?			
YES	YES	YES	YES
WORK?			
NO	NO	PART-TIME	PART-TIME/ FULL TIME

* After receiving Certificate of Initial Mastery

Figure 2

WORKPLACE KNOW-HOW

COMPETENCIES

- PLANNING RESOURCES
- INTERPERSONAL SKILLS
- INFORMATION
- SYSTEMS
- TECHNOLOGY

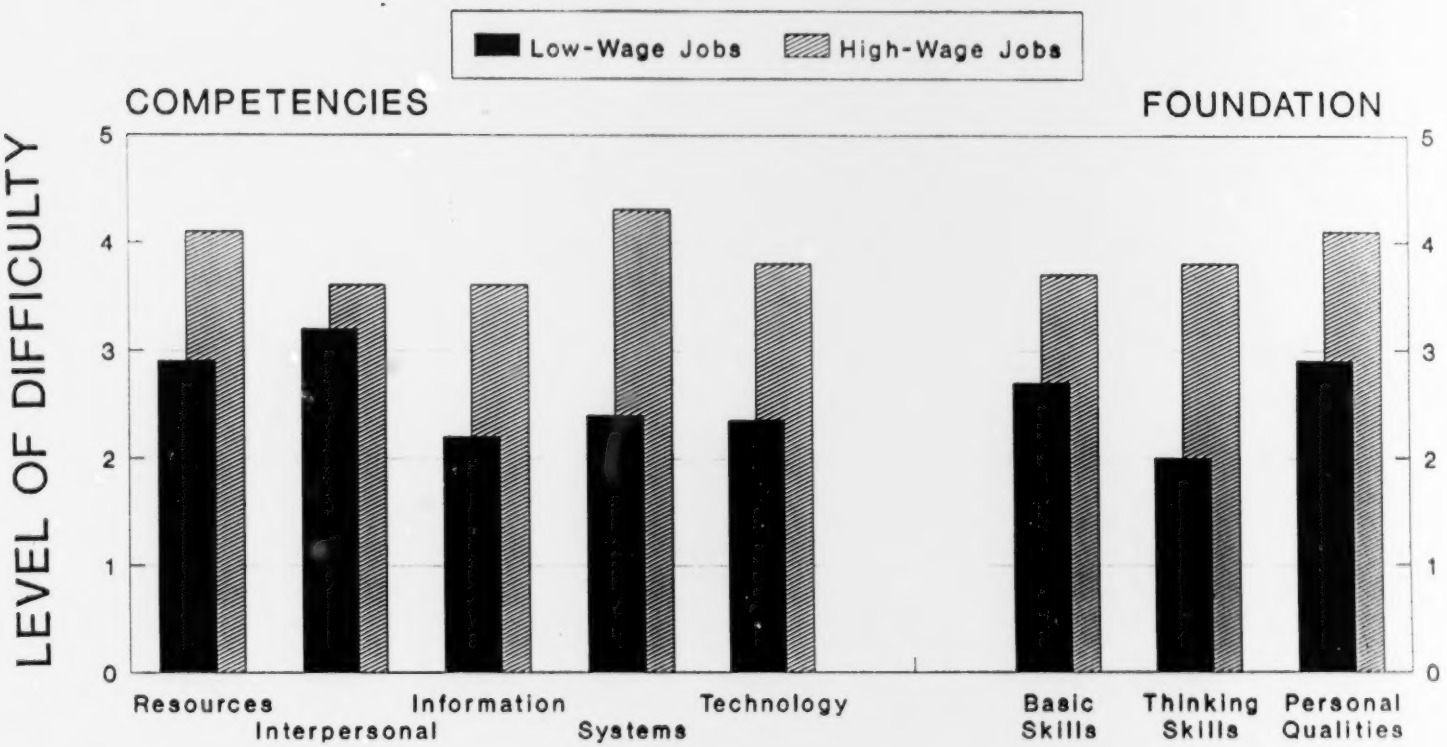
THE FOUNDATION

- BASIC SKILLS
- THINKING SKILLS
- PERSONAL QUALITIES

3a

Figure 3

AVERAGE LEVEL OF DIFFICULTY FOR THE SCANS SKILLS DEMONSTRATED IN THE 50 SCANS JOBS



Source: SCANS

Figure 4